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F4G

(54) Drying process and apparatus utilizing refrigeration cycle

(57) Drying apparatus (10,20) interposes a heat exchanger (D) between an evaporator (B) of a refrigeration system and a heater (C) so that air in a drying chamber (20) may be dried and heated in a cycle of introducing hot air in the drying chamber into the hot pass of the heat exchanger to pre-cool the hot air, guiding the pre-cooled air to the evaporator (B) to dry it due to dehumidification by cooling, introducing the pre-cooled and dried air into the cold pass of the heat exchanger (D) to increase the temperature, introducing the thus reheated air to the heater (C) to further heat it and returning the dried and further heater air to the interior of the drying chamer (20). The heater (C) may be a condensor of the refrigeration system.

FIG.1

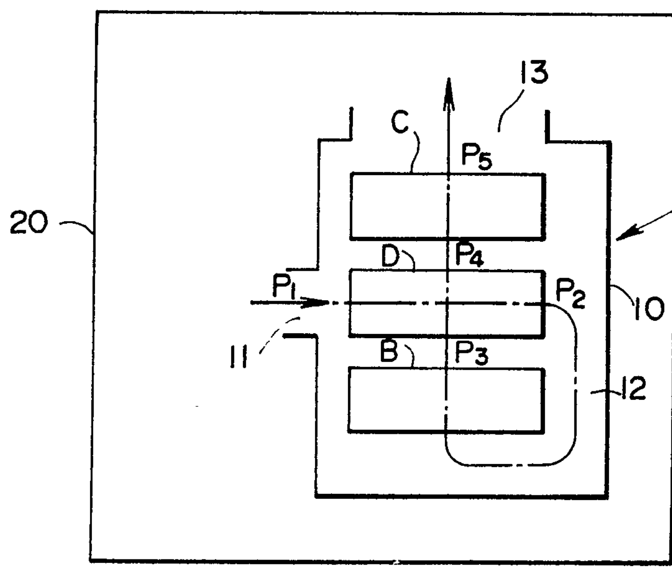

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FIG.1

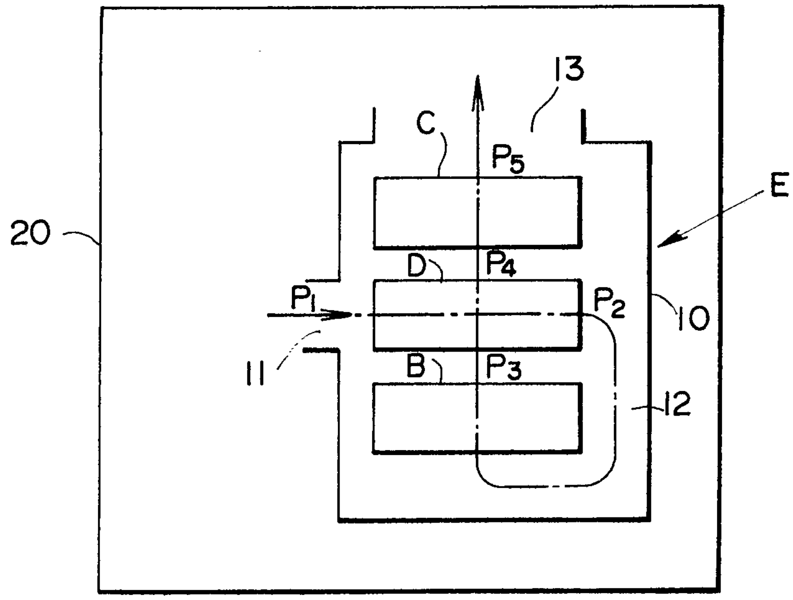

FIG.2

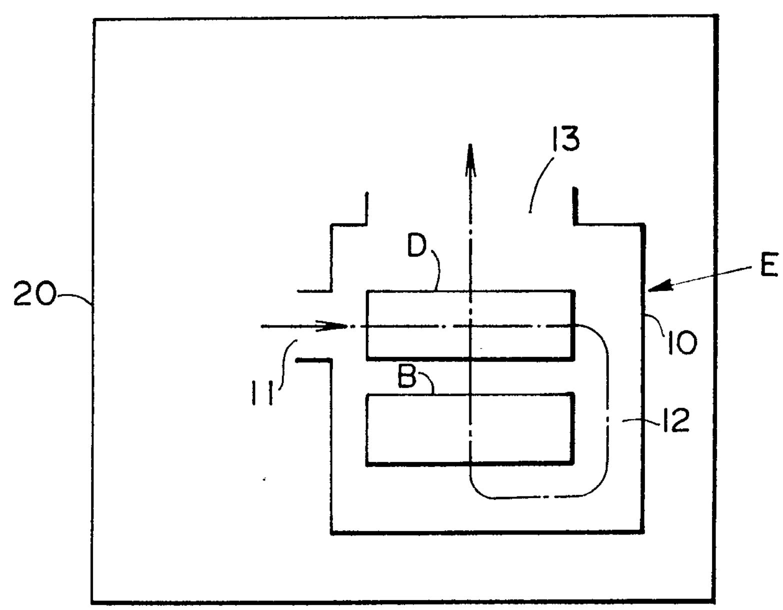

FIG.3

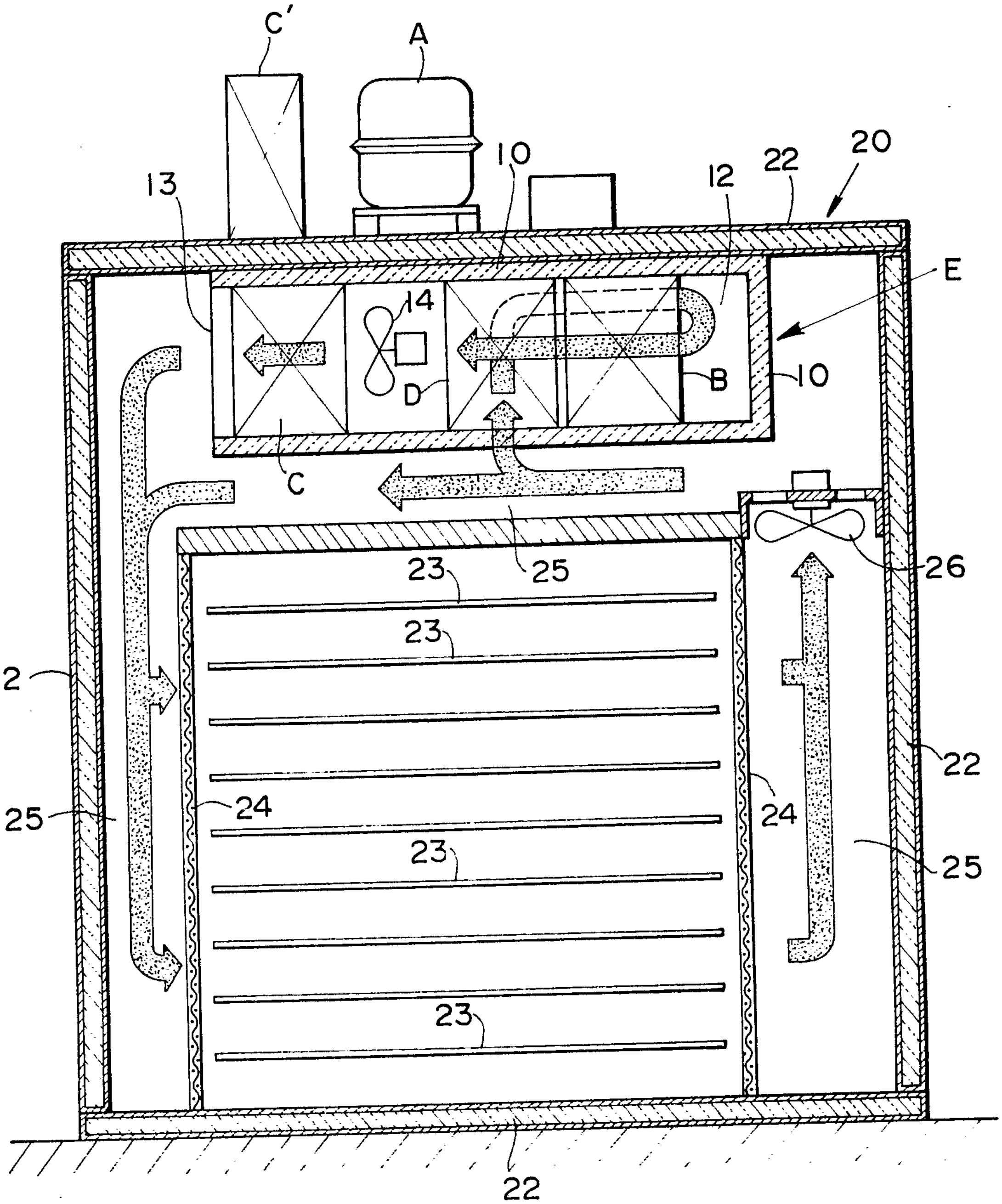

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FIG.4

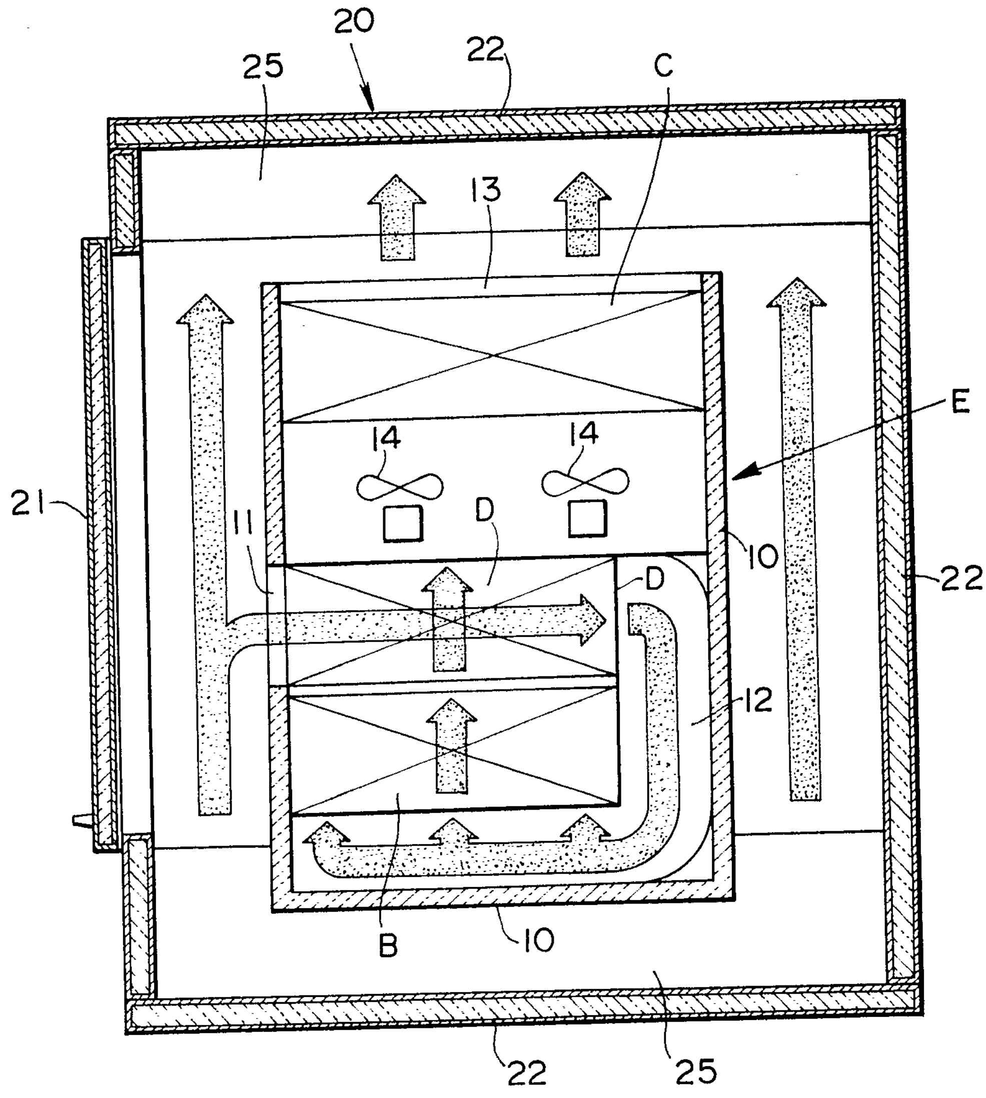

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FIG.5

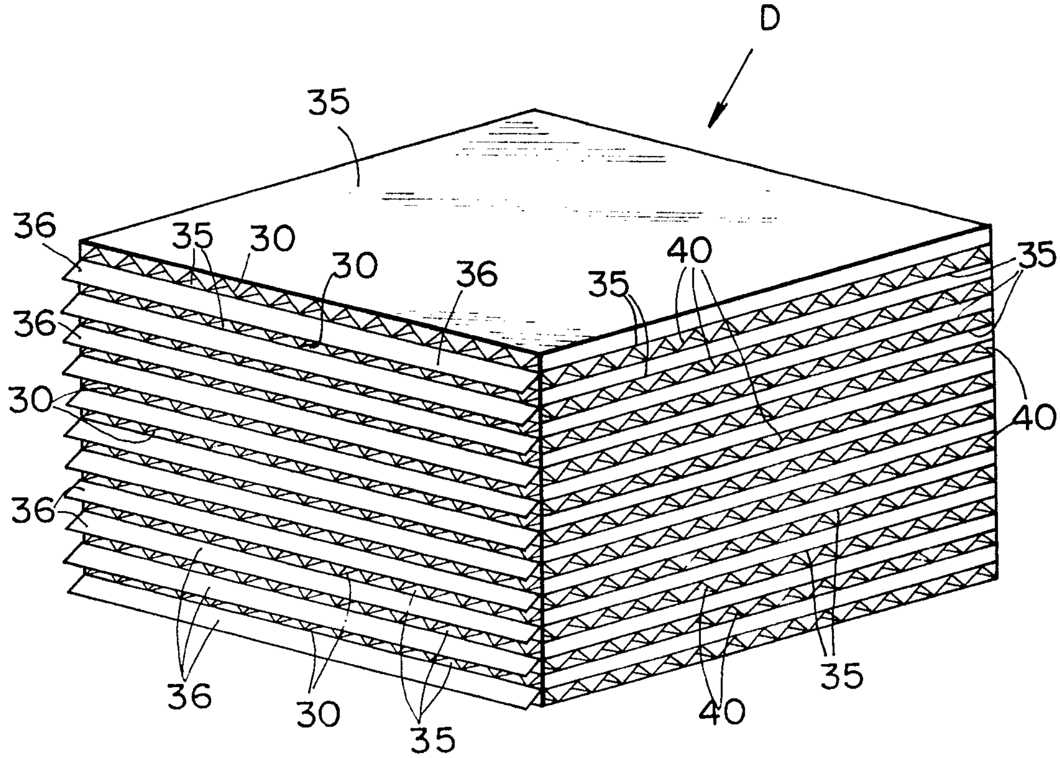


FIG.6

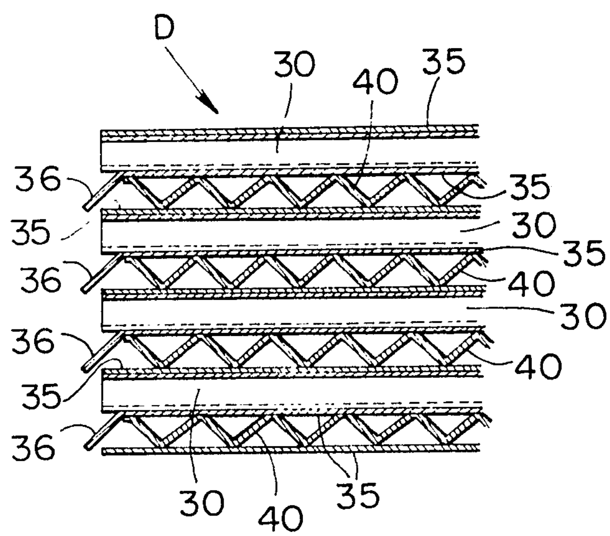
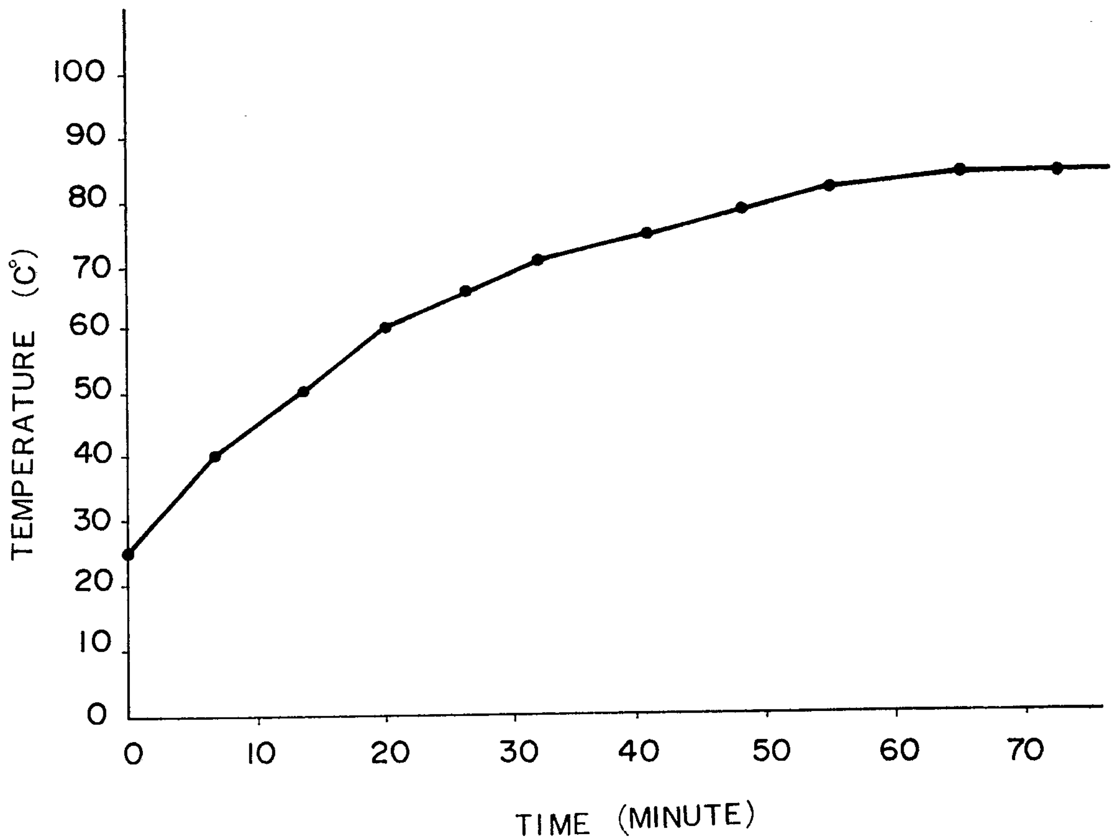


FIG.7



100
90
80
70
60
50
40
30
20
10
0
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0
10
20
30
40
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TIME (MINUTE)

616

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FIG.8

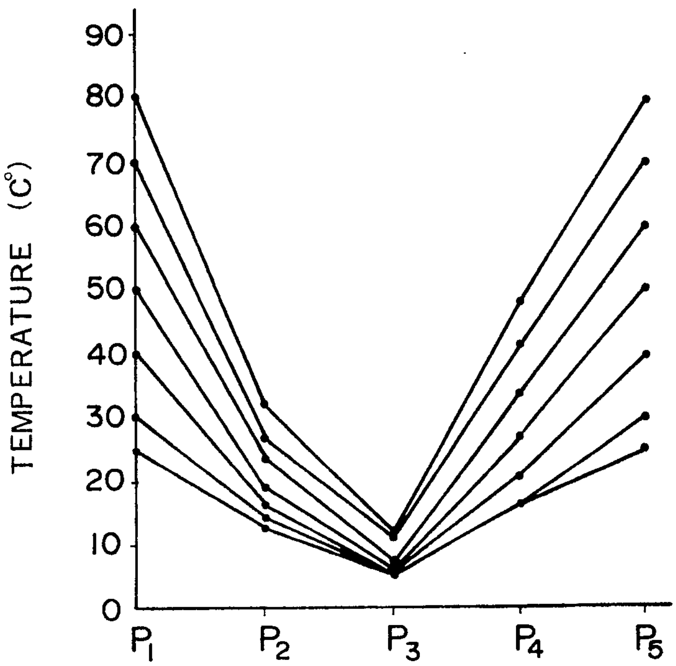
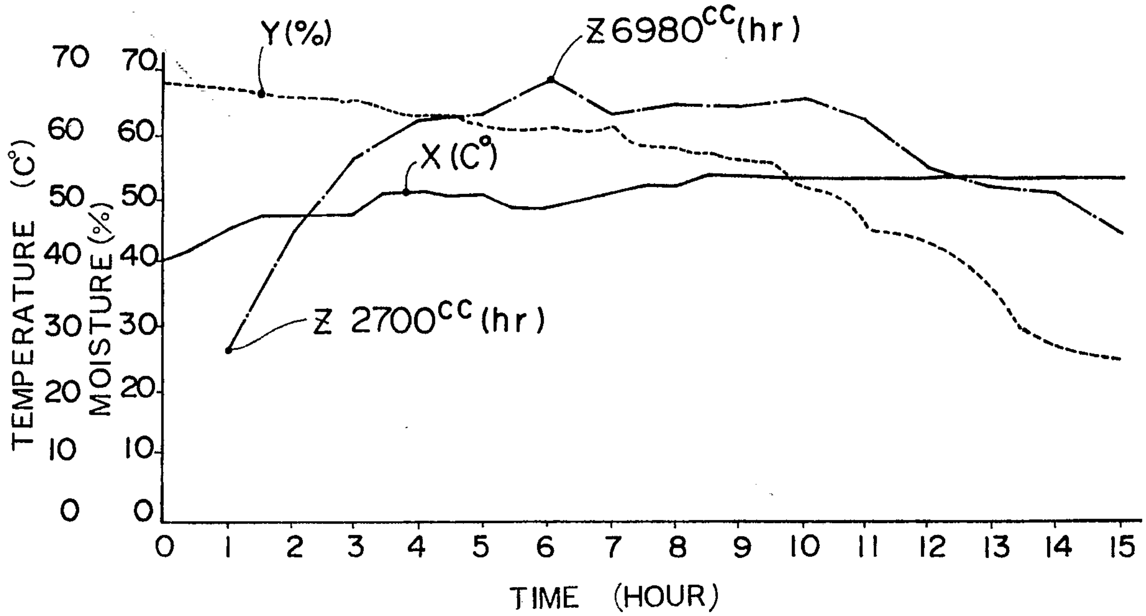


FIG.9



SPECIFICATION

Drying process and apparatus utilizing refrigeration cycle

This invention relates in general to a drying process and apparatus adapted for use in drying material, for example grain, agricultural products, marine products, wood and the like, efficiently at a relatively high temperature.

Recently, a refrigeration system has been widely used in an apparatus for drying various kinds of products such as rice, wheat, bean, potato, tobacco, herb, sea food, wood and the like, in view of the fact that such a system exhibits an excellent ability to effectively dry air by dehumidification. Such a drying apparatus is constructed for installation of the refrigeration system in the interior or on the exterior of a drying chamber to dehumidify air in the chamber by evaporator cooling and drying to reheat the dried air using a suitable heating means such as an electric heater, a condenser or the like, and then to return the dried and reheated air to the drying chamber. The utilization of the refrigeration system as a dryer can exhibit excellent dehumidification of air, and the reheating of the cooled and dried air can be readily-effected by means of a heater or the like. However, such a drying system only keeps the drying chamber at a temperature as high as 30 to 40°C. Accordingly, this system is effective to carry out drying at a relatively low temperatuer of at most 30 to 40°C, because it can withstand continuous service for a long period of time at such low temperature.

However, as a matter of fact, ideal drying of such products as described above must be carried out by keeping the products at a higher temperature of approximately 60 to 80°C for a long period of time. Therefore, the known drying system utilizing a refrigeration cycle is not suitable for accomplishing effective drying of such products, because the drying temperature is too low.

Such a disadvantage of the known drying system may be overcome by using a suitable heating means such as a heater of a larger capacity to heat the drying chamber to a desired temperature of 60 to 80°C. In this case, the drying chamber is readily heated to the desired temperature. However, when air in the drying chamber heated to this high temperature by the heater is introduced into a refrigeration system directly and without limiting the rate of hot air to be introduced, the effectiveness of the evaporator in cooling the air is reduced, because the temperature of the air is so high that it exceeds the cooling capacity of the evaporator, and the high-temperature air which has failed to be cooled sufficiently is then passed to the condenser or other heater to be re-heated. This allows the temperature of the drying chamber to be increased but causes the dehumidification effect of the refrigeration system to be substantially decreased. The refrigerator compressor is overloaded because of the evaporator being exposed to too high a temperature, and the whole refrigeration system is over the limit of its capacity, resulting in its power consumption being too large and the refrigerator system being eventually damaged.

In general, various requirements have to be met in order that the refrigeration system may reliably exhibit its performance and effectively provide continuous service for a long period of time when it is used for drying. In this regard, it is essential to keep the air to be introduced to the evaporator to a temperature below approximately 40°C. If not, such disadvantages as described above are created.

More particularly, dehumidification by means of the evaporator can then be effectively carried out as the difference between a temperature of the air to be introduced thereto and the dew point of that air is large. Supposing that air having a temperature of 30 to 40°C or less introduced to the evaporator is cooled to about 0 to 5°C which is near the dew point, moisture in air can be efficiently removed as condensate, because the temperature difference therebetween is 30 to 35°C which is large enough to accomplish dehumidification by condensation at the evaporator. On the contrary, supposing that air at about 60 to 80°C is introduced directly to the evaporator and cooled to about 40°C, dehumidification of the air does not substantially occur even though the said temperature difference of the air is significantly large, because the temperature of cooled air is far above the dew point.

Further, an apparatus for drying-products as described above is required to be continuously used day and night extending over a long period of time. It is possible for a conventional drying apparatus utilizing the combustion energy of fuel such as petroleum to carry out such continuous service, however, the use of petroleum causes the running costs to be extremely high. Moreover, the known drying apparatus using a refrigeration cycle involves overload problems such as are described above and is not suitable for use in industry at all. Accordingly, there is a strong demand for a reliable drying process and apparatus which can allow a refrigeration system to be continuously driven for a long period of time while keeping the air in the drying chamber, when there are no products therein, at a temperature in the range of about 60 to 80°C.

The present invention has been made in view of the foregoing disadvantages of the known drying apparatus utilizing a refrigeration cycle.

Accordingly, it is one object of the present invention to provide an effective drying process and apparatus which are capable of utilizing a refrigeration system in continuous operation for a long period of time while keeping air in a drying chamber at a high temperature, without causing the refrigeration system to be damaged.

It is another object of the present invention to provide a drying process and its apparatus which are capable of allowing substantially all the heat energy of a refrigeration system to be utilized in a drying chamber in a manner which significantly improves energy saving and substantially decreases the running costs by recirculating only the drying chamber air and discharging only condensate water through a drain pipe to the exterior of the drying chamber for dehumidification purposes, without allowing any access of external air to the interior of the drying chamber.

According to the invention, a heat exchanger interposed downstream of the evaporator of a refrigeration system is used to precool a flow of hot air from a drying chamber before it is supplied to the evaporator for further cooling and dehumidification, the said precooling being effected by heat exchange with the cooled and dried air leaving the evaporator.

A heater, for example a condenser of the refrigeration, may be situated downstream of the cold pass of the heat exchanger to raise the temperature of the air flow leaving the cold pass of the heat exchanger to a higher temperature before it is returned to mix with the drying air in the drying chamber.

The present invention has been made in view of the fact that a prerequisite for allowing a refrigeration system to act effectively as a dryer continuously for a long period of time within the limits of its capacity is to prevent the evaporator from being subjected to a large amount of air having a high temperature in a drying chamber. More particularly, the present invention permits drying chamber air to be substantially cooled, for example to a temperature of about 40°C or less, prior to the introduction of the air to the evaporator at a rate which is limited to prevent the evaporator from being introduced unrestrictedly to a large amount of air in the drying chamber, so that the refrigeration system may be continuously driven for a long period of time under the ideal performance conditions while keeping air in the drying chamber at a high temperature.

The invention from one aspect comprises a drying process utilizing a refrigeration cycle, which comprises passing through a heat exchanger a flow of hot air derived from a quantity of hot drying air circulating in a drying chamber, so as to precool the air flow by heat exchange, directing the precooled air flow to an evaporator of a refrigeration system to flow in heat exchange relationship therewith so as to further cool the air and to dry it by dehumidification due to the said further cooling, passing the further cooled and dried airflow from the evaporator through the heat exchanger so as to reheat it by heat exchange with the hot air flow derived from the drying chamber thus effecting the precooling of the hot air flow, and returning the reheated air flow to the drying chamber to mix with the remaining drying air circulating therein for drying articles in the chamber.

The process may include further heating the reheated air flow to a higher temperature before returning it to mix with the remaining drying air in the drying chamber. This further heating may be performed by means of a condenser of the refrigeration system.

From another aspect, the invention comprises a drying apparatus utilizing a refrigeration cycle, which is suitable for performing the above-mentioned process, and which comprises a drying chamber, and a housing having an air inlet and an air outlet both communicating with the interior of the drying chamber, a refrigeration system including an evaporator, the evaporator being contained in the housing together with a heat exchanger, and there being an air flow path defined within the housing and extending from its air inlet through the hot pass of the heat exchanger, thence past the evaporator in heat exchange relationship therewith, thence through the cold pass of the heat exchanger, and thence to the air outlet, and means for causing a flow of air from the interior of the drying chamber to flow into the air inlet and along the said air flow path within the housing to the air outlet and thence back into the interior of the drying chamber.

A heater, for example a condenser of the refrigeration system, may be disposed in the housing and interposed in the air flow path between and in series with the cold pass of the heat exchanger and the air outlet.

Thus, in one embodiment of the present invention, a part of the air in the drying chamber having a temperature of about 80°C is introduced at a restricted rate into the hot pass of a heat exchanger interposed between an evaporator and a heater such as a condenser, an electric heater or the like through an intake thereof to be pre-cooled to a temperature of about 35 to 10°C by heat exchange. Then, the pre-cooled air is introduced to the evaporator to be further cooled to a temperature of about 15 to 5°C to be dried due to dehumidification, and is, in turn, returned to the cold pass of the heat exchanger to be subjected to heat exchange again. Accordingly heat exchange can be carried out between a portion of the high-temperature air in the drying chamber and air cooled by the evaporator to cool the former air and to heat the latter air. As a result, hot air from the drying chamber to be introduced to the evaporator is cooled to an appropriate temperature.

As is apparent from the foregoing, a principal object of the present invention is to enable a continuous drying operation to be carried out for a long period of time while keeping the drying chamber at a high temperature of about 60 to 80°C. However, it is a matter of course that the present invention is also capable of carrying out continuous drying operation at a low temperature of about 5 to 15°C and a normal temperature of about 15 to 40°C as in the known refrigeration drying system. The continuous drying operation at such a low or normal temperature can be accomplished by only an interaction between an evaporator and a heat exchanger without using any heater. However, any suitable heater such as a condenser, an electric heater or the like may be used so as to effect close temperature control. In this instance, the heater may be installed in a dehumidifying and heating unit or in other suitable place, for example, in the interior of the drying chamber.

The invention may be carried into practice in various ways, but certain specific embodiments thereof will now be described by way of example only and with reference to the accompanying drawings, in which

Figure 1 is a schematic diagram of a drying system according to the present invention;

Figure 2 is a schematic diagram showing a modification of the drying system of Figure 7;

Figure 3 is a vertical sectional elevation view of a drying apparatus embodying the system of Figure 1;

Figure 4 is a plan view of the drying apparatus shown in Figure 3 with the top panel removed therefrom; Figure 5 is a perspective view of a heat exchanger construction which may be employed in a drying system embodying the present invention;

Figure 6 is a partly enlarged sectional view of the heat exchanger shown in Figure 5;

Figure 7 is a graph showing relationship between the temperature rise within the drying chamber and the time required to elevate the temperature;

Figure 8 is a graph showing the temperature variation of air within the dehumidifying and heating unit; and

Figure 9 is a graph showing variations of temperature and humidity in the drying chamber and also amount of drain water to be discharged from the drying chamber as a function of time when test blanket pieces soaked in water are dried by using the drying apparatus of the Figures 3 and 4.

In the accompanying drawings, like reference numerals identify like elements of structure in each of several figures.

The present invention is directed to a drying system which is adapted to carry out dehumidification of air in a drying chamber having articles stored therein to dry, using any one of various conventional refrigeration systems such as a compression refrigeration system, an absorption referigeration system and the like. Referring to Figure 1 showing a drying system embodying the present invention, the system comprises a compressor, an evaporator B and a heater C such as a condensor, an electric heater, a combination thereof or the like.

As shown in Figure 1, the evaporator B and heater C are arranged in a heat-insulating housing 10 so as to be spaced from each other at a suitable distance and a heat exchanger D is disposed between the evaporator B and the heater C. The housing 10 is provided with an air inlet 11 in a wall thereof facing one side of the heat exchanger D and is formed with an air passage 12 therein which extends from the other side of the heat exchanger along the walls of the housing 10 to the front side of the evaporator B. The housing 10 also has an air outlet 13 provided at the rear of the heater C. The dehumidifying and heating unit E thus formed is installed in a heat-insulating drying chamber 20 which as shown in Figures 3 and 4 is constructed of heat-insulating panels 22 and has an entrance door 21. Whilst the unit E may be installed wholly on the exterior of the chamber 20, in the embodiment of Figures 3 and 4 the unit E is installed in the interior of the drying chamber 20 but with its compressor A external thereto. In the embodiment of Figures 3 and 4, a part of the air in the drying chamber is repeatedly circulated by means of a fan 14 in a flow path which starts outside the housing 10 in the interior of the drying chamber 20 and follows to the inlet 11, the hot pass of the heat exchanger D, passage 12, evaporator B, the cold pass of the heat exchanger D, heater C, outlet 13 and back into the interior of the chamber 20, to carry out therein drying of the articles stored in the chamber 20. The circulation of air through the unit E is conveniently carried out by means of a suitable suction fan or blower 14 provided between the heat exchanger D and the heater C, which ensures that the hot drying chamber air is drawn through the heat exchanger and the evaporator B at a suitably restricted rate.

The circulation of air in the path described above allows the interior of the drying chamber to be elevated to a desired temperature of, for example, 60 to 80°C. The hot air drawn from the chamber 20 through the inlet 11 is subjected to heat exchange with previously-inducted cooled and dried air from the evaporator B passing through the cold pass of the heat exchanger D, so that the heated air is precooled to a temperature suitable for allowing the refrigeration system to fully exhibit its-capacity, for example, about 35 to 25°C. The precooled air is then introduced to the evaporator B to be further cooled to a temperature of about 15 to 5°C for the purpose of drying due to dehumidification. A drainage passage (not shown) is provided for leading the condensate water from the evaporator B to the exterior of the chamber 20. Then, the cooled and dried air is passed from the evaporator to the heat exchanger D, in which heat exchange takes place between the cooled air and hot air newly-introduced thereinto from the interior of the drying chamber, to reheat the cooled air to a temperature of about 35 to 50°C. Finally, the reheated air is guided to the heater C, which may be a condenser of the refrigeration system, or an electric heater or the like, to be further heated to about 60 to 80°C which is a desired temperature of the drying chamber 20, and is returned to the interior of the drying chamber to be used for drying the articles.

The condenser or other heater C used in Figures 1, 2 and 3 is not required to be provided within the dehumidifying and heating unit E when the drying is carried out at a low temperature or a normal temperature. Figure 2 shows such a modified unit E. In this instance, the condensor of the refrigeration system may be installed at a suitable place in the interior or exterior of the drying chamber, and air reheated by heat exchange in the heat exchanger D may be returned directly to the interior of the drying chamber without first introducing it to a further heater.

In the embodiment shown in Figures 3 and 4, the unit E is arranged at a ceiling of the drying chamber 20. However, it may be installed at the outside of the chamber 20, for example, on the top wall or side wall of the chamber. Also, it may be installed separate from the drying chamber so long as the inlet 11 and outlet 13 are communicated with the interior of the chamber 20.

Other components of the refrigeration system, for example, the compressor A, a receiver tank and an accumulator in a compression refrigerating machine, an auxiliary condenser C' and the like are arranged at appropriate places such as the ceiling of the chamber 20 in proximity to the unit E.

The term "evaporator" used herein in relation to the item B implies the cooler portion of any suitable refrigeration system, such as an actual evaporator, a cooling coil, a cooling pipe, a unit cooler or the like as used in various types of refrigeration system which include a compression refrigerating machine, an absorption refrigeration machine, etc. Thus, the term "evaporator" could be replaced by the term "cooler".

As explained hereinabove, the heat exchanger D merely acts to carry out heat exchange between hot air introduced through the inlet 11 to the evaporator B and cooled air which has already been passed through the evaporator B. Therefore, a heat exchanger of a conventional structure may be used as the heat exchanger D. The heat exchanger may be constructed as desired, for example, in a rectangular block shape such as shown in Figures 5 and 6. The heat exchanger D shown in Figures 5 and 6 comprises a plurality of thin corrugated aluminium sheets 30 and 40 arranged generally in parallel with one another at small intervals with their corrugations extending alternately perpendicular with each other and separated by means of flat partition plates 35 interposed between the respective adjacent sheets 30 and 40. Reference numeral 36 designates drainage means formed by obliquely downwardly bending the projecting end of alternate flat partition plates 35 at one side face of the structure D, namely the inlet side of the hot pass, to allow the water droplets produced by cooling due to heat exchange to successfully drop without choking up the air inlets provided at the lower portion of that side of the heat exchanger D for the entrance of the hot air from the inlet 11. If desired, downwardly-oblique projecting lips 36 could be provided at both the inlet and the outlet side of the hot pass of the heat exchanger D. The drainage water is conducted from the heat exchanger to the aforementioned drainage passage, or to a further drainage passage leading to the exterior of the drying chamber 20.

Reference character C' (Figure 3) designates an auxiliary condenser which may be installed on the outside of the unit E if desired, and which acts to substantially remedy any shortage of the condensation capacity of the refrigerator in the case where the condenser C provided in the unit E mainly serves to heat the drying chamber air. Also, in the drying system of the present embodiment, it is preferable to enclose shelves 23 on which to place articles to be dried with a suitable vented enclosure means such as a mesh structure 24, to form an airway 25 in the drying chamber 20, and to install an air circulator such as a fan 26 in the chamber so that dried air at a high temperature may be uniformly circulated in the whole chamber to evenly contact the articles so as to carry out uniform drying of the articles.

Figure 7 is a graph showing the relationship between the temperature rise within the drying chamber 20 and the time required to elevate the temperature, when a refrigeration system having an output of 2Hp and operating at AC 200V is installed in a drying chamber 20 of approximately 4.3 m^3 in volume and is operated without containing any article to be dried within the drying chamber 20. As is apparent from Figure 7, the temperature within the drying chamber 20 rises to 80°C from a normal temperature of approximately 25°C in one hour or less and maintains a temperature of approximately 80 to 85°C thereafter. In this experiment, the refrigeration system was not at all adversely affected by the continuous operation of the refrigeration system for more than ten days whilst maintaining the temperature within the empty drying chamber 20 at approximately

80 to 85°C.

Figure 8 is a graph showing the variation in temperature within the dehumidifying and heating unit E in the drying chamber 20. In the graph, the ordinate represents the temperature, while the abscissa represents each of the positions P_1 through P_5 of the dehumidifying and heating unit E shown in Figure 1.

Figure 9 is a diagram showing as functions of time the temperature X and the humidity Y within the drying chamber 20, and also the amount of drain water Z discharged outside the drying chamber 20 through the drain pipe(s), due to the dehumidification by cooling using the evaporator B and the heat exchanger D. These characteristics were obtained by drying several tens of wet blanket pieces having a unit area of 10 cm^2 and a total weight of 100 Kg including water, which were placed evenly on the shelves 23 in the drying chamber 20. The temperature of the air circulating in the chamber 20 heated by the heater C was initially about 80°C, but was cooled down to 40°C on being contacted with the wet blanket pieces. Then, the temperature X gradually rose to approximately 55°C after 15 hours and finally elevated to 70 to 80°C after 20 hours of operation by which time (not shown in Figure 9) the blanket pieces were completely dry. As is apparent from the diagram, the humidity Y within the chamber 20 decreased as the time passed and a drainage water volume of more than 6,000 cc was discharged per hour after 5 to 10 hours of operation.

It will be readily noted from the foregoing that the present invention is capable of effectively continuously performing the cycle of introducing to the evaporator drying chamber air which has been precooled by passing through a heat-exchanger to a temperature suitable for allowing the refrigeration system to reliably carry out continuous service for a long period of time, in suitable quantities to efficiently dry the air by dehumidification in the evaporator passing the dried air through the heat exchanger to re-heat it by heat exchange with the intake of hot drying chamber air, introducing the dried and re-heated air to a heater to further heat it to a temperature desired in the drying chamber and returning hot dried air to the drying chamber, so that the whole air in the drying chamber is always hot and dried sufficient to effectively dry articles stored in the chamber. Thus, the present invention is very useful for drying various kinds of articles requiring to be dried at a high temperature over a relatively long period of time, and is advantageously applicable to drying agricultural products, marine products, wood, industrial products and the like.

CLAIMS

1. A drying process utilising a refrigeration cycle, which comprises passing through a heat exchanger a flow of hot air derived from a quantity of hot drying air circulating in a drying chamber, so as to precool the air flow by heat exchange, directing the precooled air flow to an evaporator of a refrigeration system to flow in heat exchange relationship therewith so as to further cool the air flow and to dry it by dehumidification due to the said further cooling, passing the further cooled and dried air flow from the evaporator through the heat exchanger so as to reheat it by heat exchange with the hot air flow derived from the drying chamber thus effecting the precooling of the hot air flow, and returning the reheated air flow to the drying chamber to mix with the remaining drying air circulating therein for drying articles in the chamber.

2. A drying process as claimed in claim 1, which includes further heating the reheated air flow to a higher temperature before returning it to mix with the remaining drying air in the drying chamber.

3. A process as claimed in claim 2, in which the further heating of the reheated air flow is effected by means of a condenser of the refrigeration system.

4. A drying apparatus utilising a refrigeration cycle, which comprises a drying chamber, and a housing having an air inlet and an air outlet both communicating with the interior of the drying chamber, a refrigeration system including an evaporator, the evaporator being contained in the housing together with a heat exchanger, and there being an air flow path defined within the housing and extending from its air inlet through the hot pass of the heat exchanger, thence past the evaporator in heat exchange relationship therewith, thence through the cold pass of the heat exchanger, and thence to the air outlet, and means for causing a flow of air from the interior of the drying chamber to flow into the air inlet and along the said air flow path within the housing to the air outlet and thence back into the interior of the drying chamber.

5. Apparatus as claimed in claim 4, including a heater disposed within the housing and interposed in the said air flow path between and in series with the cold pass of the heat exchanger and the air outlet.

6. Apparatus as claimed in claim 5, in which the heater comprises a condenser of the refrigeration system.

7. Apparatus as claimed in claim 5, in which the heater is an electric heater.

8. Apparatus as claimed in claim 5, in which the heater includes both a condenser of the refrigeration system and an electric heater.

9. Apparatus as claimed in any one of claims 4 to 8, including further means for causing a circulation of the air contained within the interior of the drying chamber to dry material stored therein.

10. Apparatus as claimed in any one of claims 4 to 9, in which the housing is dis-

posed within the interior of the drying chamber.

11. Apparatus as claimed in any one of claims 4 to 9, in which the housing is disposed outside the drying chamber, with its air inlet and outlet communicating with the interior of the drying chamber via apertures in the wall thereof.

12. Apparatus as claimed in any one of claims 4 to 11, in which the drying chamber, and/or housing, have heat-insulating walls.

13. Apparatus as claimed in any one of claims 4 to 12, in which the means for causing a flow of air along the said air flow path comprises an air suction or delivery means, e.g. a fan.

14. Apparatus as claimed in claim 13, in which the air suction or delivery means comprises a fan interposed in the air flow path downstream of the cold pass of the heat exchanger.

15. A dehumidifying and heating unit adapted to be used in conjunction with a drying apparatus as claimed in any one of claims 4 to 14, comprising a refrigeration system including an evaporator, a housing having an air inlet and an air outlet, and containing a heat exchanger and the evaporator, and there being an air flow path defined within the housing and extending from the air inlet through the hot path of the heat exchanger thence past the evaporator in heat exchange relationship therewith, thence through the cold pass of the heat excharger, and thence to the air outlet.

16. A unit as claimed in claim 15, including a heater disposed within the housing and interposed in the air flow path between and in series with the cold pass of the heat exchanger and the air outlet.

17. A unit as claimed in claim 16, in which the heater comprises a condenser of the refrigeration system.

18. A unit as claimed in claim 16, in which the heater comprises an electric heater.

19. A unit as claimed in claim 16, in which the heater includes both a condenser of the refrigeration system and an electric heater.

20. A unit as claimed in any one of claims 15 to 19, whose housing has heat-insulating walls.

21. A unit as claimed in any one of claims 15 to 19, which includes means for causing a flow of air to flow into the air inlet and along the said air flow path within the housing to the air outlet to leave the housing therethrough.

22. A unit as claimed in claim 21 in which the said means for causing a flow of air to flow comprises an air suction or delivery means.

23. A unit as claimed in claim 21 in which the said means for causing a flow of air to flow comprises a fan disposed in the air flow path downstream of the heat exchanger.

24. A method of drying utilising a refrigeration cycle, substantially as specifically described herein with reference to Figures 1, 3 and 4 or to Figure 2 of the accompanying drawings.

25. Apparatus for drying utilising a refrigeration cycle, substantially as specifically described herein with reference to Figures 1, 3 and 4 or to Figures 1, 3, 4, 5 and 6, or to Figure 2, of the accompanying drawings.

26. A drying and dehumidifying unit for use with a drying chamber, substantially as specifically described herein with reference to Figures 1, 3 and 4, or to Figures 1 and 3 to 6, or to Figure 2, of the accompanying drawings.

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